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L45: Entry 18 of 24 File: USPT Dec 21, 1999

DOCUMENT-IDENTIFIER: US 6005916 A
**** See image for Certificate of Correction ****
TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

Parent Case Text (1):
This patent application is a continuation of U.S. patent application Ser. No. 08/706,205 filed on Aug. 29, 1996, which is a continuation-in-part of U.S. patent application Ser. No. 08/486,971 filed on Jun. 22, 1995 now abandoned, which is a continuation-in-part of U.S. patent application Ser. No. 07/961,768 filed on Oct. 14, 1992 now U.S. Pat. No. 5,588,032, all of which are incorporated herein by reference.

Brief Summary Text (8):
Other imaging methods have been applied to one or the other modality, or restricted to acoustic or elastic media, the method described in this patent is applicable to any type of wave motion, whether electromagnetic, elastic (including shear wave effects) or acoustic (scalar approximation valid in liquid and gases). Furthermore, the ambient media may have some forms of structure (layering) or microstructure (porosity) relevant to the medical, geophysical, or nondestructive imaging applications envisioned for this technology. In the prior art the presence of this layering or porosity has greatly diminished the effectiveness of the imaging program. The method of this patent minimizes the obscuring effect of such structures in the ambient media. In addition, we have made several changes to the previous U.S. Pat. No. 4,662,222 that significantly extend the applicability and speed of our algorithm. These changes are described, in part, below:

Brief Summary Text (25):
Although similar techniques have appeared in the scientific literature as theory only or in algorithms that, due to lack of efficiency, cannot handle problems of practical size, these methods are substantially different from other algorithms that cannot be used in a practical imaging device such as Diffraction Tomography, Colton and Monk's method. Although some of the methods introduced by Borup, Johnson, Wiskin, and co-workers were available earlier, other factors had to come together before the present apparatus and method become applicable to concrete problems in medical imaging, geophysical imaging, and nondestructive imaging (NDI) in layered and porous media.

Brief Summary Text (27):
This observation is supported by the fact that although there has been a pressing need for high resolution imaging technology for several decades in the medical, NDI and geophysical fields, there has never been, until now, a successful implementation capable of solving practical problems. In particular

Brief Summary Text (32):
A. breast scanners, medical imaging

Brief Summary Text (45):
This generalization of the free space Green's function to this new type of environment was certainly known to be possible in theory. The true difficulty lay

in the ability to construct the inverse scattering algorithm and Green's function in such a way that "convolution" is preserved, since it is the convolutional character that allows the use of the Fast Fourier Transform (FFT), which in turn makes the imaging process practical for the medical/geophysical/Nondestructive Evaluation (NDE) scanners mentioned above. (Actually it is convolution/correlation which is preserved, however, the correlation is accomplished by turning it into a convolution via a mathematical transformation.) It is this convolution property that enables us to perform the inversion with such unusual speed. There are several non-trivial changes to the flowcharts that must be made in order to accommodate the effects of the layering, these changes are shown below in the accompanying flowcharts.

Brief Summary Text (53):
5. The examples given in this patent all assume that the different frequencies, .omega., and source positions, .phi., are all computed in serial fashion. It is important to note, however, that another important link in the real time implementation of our algorithm, is the fact that the different frequencies and different views are independent computations (in both the forward problem and Jacobian calculations), and therefore can be computed in parallel. The implementation of this parallelization is explained in detail below. The omission of any one of these important links renders the algorithm intolerably slow for the practical medical/geophysical/NDE scanners listed above.

Brief Summary Text (57):
Electromagnetic Medical Imaging

Brief Summary Text (63):
11. Furthermore, all the advantages over state of the art discussed in the previous patent remain in the present one, and with the additional improvements enumerated above. The speed up of the imaging process, even though it covers several orders of magnitude, does not result from any degradation in image quality, just as discussed in the previous patent. Virtually all the quantitative tissue characterization capabilities of the previous algorithm are retained in the present case, with its substantial improvement over the B-scanners presently in use for medical diagnostic imaging.

Brief Summary Text (68):
It is very important to note that these calculations do not make any use of the parallelizability of our methods and hardware. The implementation of the simple-minded parallelization discussed in this patent results in an immediate speedup of 10 to 100 times, allowing us to do much larger problems in minutes versus the 8 hours required by the conventional approaches. This is very rough, however, the simple calculation above supports our claim that our methods far surpass present technology in wave-field imaging. The 100 by 100 problem is large enough to be practical for applications in medical technology, geophysical imaging, non-destructive testing, and environmental imaging that require a high degree of resolution in real time. For those situations that require the application of multiple frequencies (such as multiparameter imaging, and such as for reflection mode imaging) a smaller edge dimension is called for, however, the resolution achievable with our technology is much greater than present state of the art.

Brief Summary Text (598):
The scientific background to the phase aberration correction based upon the brightness functional is simply that the L.sub.2 norm (functional) of the B-scan image intensity is maximized when the phase shifts (time delays) are such that the image is maximally focused [L. Nock and G. E. Trahey, "Phase aberration correction in medical ultrasound using speckle brightness as a quality factor," Journ. Acoustical Society of America, 1989, 85, 1819-1833, herein included as reference].

Detailed Description Text (2):

The apparatus and method of the present invention holds promise for many useful applications in various fields, including seismic surveying, nondestructive testing, sonar, radar, ground penetrating radar, optical microscopes, x-ray microscopes, and medical ultrasound imaging, to name just a few. For purposes of illustrating the utility of the present invention, the detailed description which follows will emphasize the apparatus and method of the invention in the context of a system for use in performing ultrasound imaging of human organs, such as the breast. However, it will be appreciated that the present invention as claimed herein may employ other forms of energy such as microwaves, light or elastic waves and furthermore may be used in other fields and is not intended to be limited solely to medical acoustic imaging.

Detailed Description Text (4):
Reference is first made to FIG. 1 which generally illustrates one type of scanner which may be used to implement the apparatus and method of the present invention for purposes of medical ultrasound imaging of a human breast or other organs. As shown in FIG. 1, the scanning apparatus generally designated at 30 includes fixed base 32. Wheels 38 and 40 are attached to the underside of a movable carriage base 34. Small shoulders 42-45 formed on the upper surface of cylindrical pedestal 36 define a track along which the wheels 38 and 40 are guided.

Detailed Description Text (38):
Such one-dimensional and two-dimensional arrays of receivers and transmitters have a direct application to advanced medical imaging instruments where motion of the array is undesirable or in seismic exploration in which such movements are difficult. FIG. 4E illustrates how each element 131a through 131n may be switched to either a transmitter circuit or a receiver circuit. Here, for example, element 131a is switched by switch 137a to either a receiver circuit 133a or a transmitter circuit 135a. FIG. 4F shows how a passive network of diodes and resistors may be used to allow a single element to act as either a transmitter or a receiver, or in both capacities. For example, in the transmit mode, diodes 139 are driven into conduction by transmit signal on line 135a. With two silicon diodes in series in each parallel leg, the voltage drop is a few volts. Thus, for an applied transmit signal of 20 volt or more, only a small percentage of signal power is lost across diodes 139. Diodes 139 are arranged in a series parallel network so that either polarity of signal is passed to transducer element 131a with negligible loss. In the transmit mode, resistors 145, 147, and 149 and diodes 141 and 143 prevent excessive and harmful voltage from appearing at output 133a that leads to the preamplifier multiplexer, or analog-to-digital circuits that follow. In operation, resistor 145, diode 141, and resistor 149 act as a voltage divider for the large transmit voltage present at the transducer element 131a. Diodes 141 are arranged with opposing polarity to provide a path for any polarity of signal above their turn on voltage of about 0.7 to 1.0 volts. The values of resistors 145 and 149 are typically so that the impedance of resistor 145 is greater than or equal to that of the internal impedance of transducer element 131a. Resistor 149 is chosen to be some fraction of resistor 145, such as one-fifth. Resistor (resistor 147) typically is chosen to be about equal to the resistance of resistor 149. Thus,during transmission, the voltage appearing at output 133a is only the conduction voltage drop across diodes 143.

Detailed Description Text (85):
It is also important to note that all of the Appendices, with the exclusion of Appendix D, deal with the rectangular iterative method. Appendix D in distinction deals with the two-dimensional cylindrical recursion method for solving the forward problems in less time than the rectangular recursion method for Gauss-Newton iteration. It is also important to recognize that the construction of the layered Green's function as shown in Summary of the Invention, Example 2 shows explicitly how the convolution and correlation are preserved even though the distribution of the layers above and below the layer containing the image space are arbitrarily distributed. The preservation of convolution and correlation is a critical element

of the ability to image objects in a layered or Biot environment (Biot referring to the Biot theory of wave propagation in porous media) in real time. The reflection coefficients which are used in the construction of the layered Green's function in the acoustic, elastic and the electromagnetic case are well known in the literature. See, for example [Muller, 1985] or Aki and Richards, 1980. The incorporation of this Green's function for layered media in the acoustic, elastic and electromagnetic case for the express purpose of imaging objects buried within such a layered medium is novel. The ability to image in real time is critical to practical application of this technology in the medical, geophysical, non-destructive and testing microscopic environments.

Detailed Description Text (110):
FIGS. 28A and 28B show an example of the application of inverse scattering to medical imaging through the use of computer simulation. FIGS. 28A and 28B also illustrate the powerful impact of a large inverse scattering image. FIG. 28A is a photograph of a cross section of a human through the abdomen that could appear in an anatomy atlas. The image was actually made on a magnetic resonance clinical scanner. This image is 200 by 200 pixels, each pixel being 1/4 wave length square. It was used a the starting image in the process of creating synthetic scattering data. The pixel values in this image were assigned to a set of speed of sound values in a range that is typical for soft tissue. This range is typically plus or minus 5 percent of the speed of sound of water. Using this image of speed of sound the forward scattering algorithm then computed the scattered field at a set of detectors on the perimeter of the image for the case of incident plane waves for 200 source directions equally spaced in angle around 360 degrees. The detectors enclosed the cross section on all sides and numbered 4(200).times.4=796. This set of synthetic scattering data was used to compute the inverse scattering image of FIG. 28B.

Related Application Patent Number (1):
5588032

US Reference Patent Number (5):
5588032

US Reference Group (5):
5588032 19961200 Johnson et al. 378/8

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L45: Entry 22 of 24 File: USPT Dec 24, 1996

DOCUMENT-IDENTIFIER: US 5588032 A
TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

Inventor Street Address (2):
1021 Medical Towers

Inventor Group (2):
Wiskin; James W. 1021 Medical Towers Salt Lake City UT 84112

Brief Summary Text (9):
Furthermore, the ambient media may have some forms of structure (layering) or microstructure (porosity) relevant to the medical, geophysical, or nondestructive imaging applications envisioned for this technology. In the prior art the presence of this layering or porosity has greatly diminished the effectiveness of the imaging program. The method of this patent minimizes the obscuring effect of such structures in the ambient media. In addition, we have made several changes to the previous U.S. Pat. No. 4,662,222 that significantly extend the applicability and speed of our algorithm. These changes are described, in part, below:

Brief Summary Text (21):
Although similar techniques have appeared in the scientific literature as theory only or in algorithms that, due to lack of efficiency, cannot handle problems of practical size, this method is substantially different from other algorithms that cannot be used in a practical imaging device. Although some of the methods introduced by Borup, Johnson, Wiskin, and co-workers were available earlier, other factors had to come together before the present apparatus and method become applicable to concrete problems in medical imaging, geophysical imaging, and nondestructive imaging (NDI) in layered and porous media.

Brief Summary Text (23):
This observation is supported by the fact that although there has been a pressing need for high resolution imaging technology for several decades in the medical, NDI and geophysical fields, there has never been, until now, a successful implementation capable of solving practical problems. In particular

Brief Summary Text (28):
A. breast scanners, medical imaging

Brief Summary Text (42):
This generalization of the free space Green's function to this new type of environment was certainly known to be possible in theory. The true difficulty lay in the ability to construct the inverse scattering algorithm and Green's function in such a way that "convolution" is preserved, since it is the convolutional character that allows the use of the Fast Fourier Transform (FFT), which in turn makes the imaging process practical for the medical/geophysical/Nondestructive Evaluation (NDE) scanners mentioned above. (Actually it is convolution/correlation which is preserved, however, the correlation is accomplished by turning it into a convolution via a mathematical transformation.) It is this convolution property that enables us to perform the inversion with such unusual speed. There are several

non-trivial changes to the flowcharts that must be made in order to accommodate the effects of the layering, these changes are shown below in the accompanying flowcharts.

Brief Summary Text (51):
5. The examples given in this patent all assume that the different frequencies, .omega., and source positions, .phi., are all computed in serial fashion. It is important to note, however, that another important link in the real time implementation of our algorithm, is the fact that the different frequencies and different views are independent computations (in both the forward problem and Jacobian calculations), and therefore can be computed in parallel. The implementation of this parallelization is explained in detail below. The omission of any one of these important links renders the algorithm intolerably slow for the practical medical/geophysical/NDE scanners listed above.

Brief Summary Text (55):
Electromagnetic Medical Imaging

Brief Summary Text (61):
11. Furthermore, all the advantages over state of the art discussed in the previous patent remain in the present one, and with the additional improvements enumerated above. The speed up of the imaging process, even though it covers several orders of magnitude, does not result from any degradation in image quality, just as discussed in the previous patent. Virtually all the quantitative tissue characterization capabilities of the previous algorithm are retained in the present case, with its substantial improvement over the B-scanners presently in use for medical diagnostic imaging.

Brief Summary Text (66):
It is very important to note that these calculations do not make any use of the parallelizability of our methods and hardware. The implementation of the simple-minded parallelization discussed in this patent results in an immediate speedup of 10 to 100 times, allowing us to do much larger problems in minutes versus the 8 hours required by the conventional approaches. This is very rough, however, the simple calculation above supports our claim that our methods far surpass present technology in wave-field imaging. The 100 by 100 problem is large enough to be practical for applications in medical technology, geophysical imaging, non-destructive testing, and environmental imaging that require a high degree of resolution in real time. For those situations that require the application of multiple frequencies (such as multiparameter imaging, and such as for reflection mode imaging) a smaller edge dimension is called for, however, the resolution achievable with our technology is much greater than present state of the art.

Brief Summary Text (69):
The optical microscopic inversion apparatus may appear to have less immediate benefits for society, but in fact its importance in bio-medical research, bespeaks of manifold reasons for its dispersion also, as soon as possible.

Detailed Description Text (2):
The apparatus and method of the present invention holds promise for many useful applications in various fields, including seismic surveying, nondestructive testing, sonar, radar, ground penetrating radar, optical microscopes, x-ray microscopes, and medical ultrasound imaging, to name just a few. For purposes of illustrating the utility of the present invention, the detailed description which follows will emphasize the apparatus and method of the invention in the context of a system for use in performing ultrasound imaging of human organs, such as the breast. However, it will be appreciated that the present invention as claimed herein may employ other forms of energy such as microwaves, light or elastic waves and furthermore may be used in other fields and is not intended to be limited solely to medical acoustic imaging.

Detailed Description Text (4):
Reference is first made to FIG. 1 which generally illustrates one type of scanner which may be used to implement the apparatus and method of the present invention for purposes of medical ultrasound imaging of a human breast or other organs. As shown in FIG. 1, the scanning apparatus generally designated at 30 includes fixed base 32. Wheels 38 and 40 are attached to the underside of a movable carriage base 34. Small shoulders 42-45 formed on the upper surface of cylindrical pedestal 36 define a track along which the wheels 38 and 40 are guided.

Detailed Description Text (33):
Such one-dimensional and two-dimensional arrays of receivers and transmitters have a direct application to advanced medical imaging instruments where motion of the array is undesirable or in seismic exploration in which such movements are difficult. FIG. 4E illustrates how each element 131a through 131n may be switched to either a transmitter circuit or a receiver circuit. Here, for example, element 131a is switched by switch 137a to either a receiver circuit 133a or a transmitter circuit 135a. FIG. 4F shows how a passive network of diodes and resistors may be used to allow a single element to act as either a transmitter or a receiver, or in both capacities. For example, in the transmit mode, diodes 139 are driven into conduction by transmit signal on line 135a. With two silicon diodes in series in each parallel leg, the voltage drop is a few volts. Thus, for an applied transmit signal of 20 volt or more, only a small percentage of signal power is lost across diodes 139. Diodes 139 are arranged in a series parallel network so that either polarity of signal is passed to transducer element 131a with negligible loss. In the transmit mode, resistors 145, 147, and 149 and diodes 141 and 143 prevent excessive and harmful voltage from appearing at output 133a that leads to the preamplifier multiplexer, or analog-to-digital circuits that follow. In operation, resistor 145, diode 141, and resistor 149 act as a voltage divider for the large transmit voltage present at the transducer element 131a. Diodes 141 are arranged with opposing polarity to provide a path for any polarity of signal above their turn on voltage of about 0.7 to 1.0 volts. The values of resistors 145 and 149 are typically so that the impedance of resistor 145 is greater than or equal to that of the internal impedance of transducer element 131a. Resistor 149 is chosen to be some fraction of resistor 145, such as one-fifth. Resistor (resistor 147) typically is chosen to be about equal to the resistance of resistor 149. Thus, during transmission, the voltage appearing at output 133a is only the conduction voltage drop across diodes 143.

Detailed Description Text (57):
FIGS. 28A and 28B show an example of the application of inverse scattering to medical imaging through the use of computer simulation. FIGS. 28A and 28B also illustrate the powerful impact of a large inverse scattering image. FIG. 28A is a photograph of a cross section of a human through the abdomen that could appear in an anatomy atlas. The image was actually made on a magnetic resonance clinical scanner. This image is 200 by 200 pixels, each pixel being 1/4 wave length square. It was used a the starting image in the process of creating synthetic scattering data. The pixel values in this image were assigned to a set of speed of sound values in a range that is typical for soft tissue. This range is typically plus or minus 5 percent of the speed of sound of water. Using this image of speed of sound the forward scattering algorithm then computed the scattered field at a set of detectors on the perimeter of the image for the case of incident plane waves for 200 source directions equally spaced in angle around 360 degrees. The detectors enclosed the cross section on all sides and numbered 4(200).times.4=796. This set of synthetic scattering data was used to compute the inverse scattering image of FIG. 28B.

Detailed Description Text (92):
It is also important to note that all of the Appendices, with the exclusion of Appendix D, deal with the rectangular iterative method. Appendix D in distinction

deals with the two-dimensional cylindrical recursion method for solving the forward problems in less time than the rectangular recursion method for Gauss-Newton iteration. It is also important to recognize that the construction of the layered Green's function as shown in Summary of the Invention, Example 2 shows explicitly how the convolution and correlation are preserved even though the distribution of the layers above and below the layer containing the image space are arbitrarily distributed. The preservation of convolution and correlation is a critical element of the ability to image objects in a layered or Biot environment (Biot referring to the Biot theory of wave propagation in porous media) in real time. The reflection coefficients which are used in the construction of the layered Green's function in the acoustic, elastic and the electromagnetic case are well known in the literature. See, for example [Muller, 1985] or Aki and Richards, 1980. The incorporation of this Green's function for layered media in the acoustic, elastic and electromagnetic case for the express purpose of imaging objects buried within such a layered medium is novel. The ability to image in real time is critical to practical application of this technology in the medical, geophysical, non-destructive and testing microscopic environments.

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Search Results - Record(s) 1 through 24 of 24 returned.

☐ 1. Document ID: US 20040034307 A1

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L45: Entry 1 of 24                  File: PGPB                  Feb 19, 2004

PGPUB-DOCUMENT-NUMBER: 20040034307
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20040034307 A1

TITLE: Apparatus and method for imaging objects with wavefields

PUBLICATION-DATE: February 19, 2004

INVENTOR-INFORMATION:
NAME                      CITY              STATE   COUNTRY   RULE-47
Johnson, Steven A.        Salt Lake City    UT      US
Borup, David T.           Salt Lake City    UT      US
Wiskin, James             Salt Lake City    UT      US
Berggren, Michael J.      Salt Lake City    UT      US

US-CL-CURRENT: 600/459
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Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KMC | Draw D

☐ 2. Document ID: US 20020131551 A1

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L45: Entry 2 of 24                  File: PGPB                  Sep 19, 2002

PGPUB-DOCUMENT-NUMBER: 20020131551
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020131551 A1

TITLE: Apparatus and method for imaging objects with wavefields

PUBLICATION-DATE: September 19, 2002

INVENTOR-INFORMATION:
NAME                      CITY              STATE   COUNTRY   RULE-47
Johnson, Steven A.        Salt Lake City    UT      US
Borup, David T.           Salt Lake City    UT      US
Wiskin, James             Salt Lake City    UT      US
```

Berggren, Michael J. Salt Lake City UT US

US-CL-CURRENT: 378/62; 378/37

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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3. Document ID: US 6636584 B2

L45: Entry 3 of 24 File: USPT Oct 21, 2003

US-PAT-NO: 6636584
DOCUMENT-IDENTIFIER: US 6636584 B2

TITLE: Apparatus and method for imaging objects with wavefields

DATE-ISSUED: October 21, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT		
Borup; David T.	Salt Lake City	UT		
Wiskin; James	Salt Lake City	UT		
Berggren; Michael J.	Salt Lake City	UT		

US-CL-CURRENT: 378/37, 378/62, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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4. Document ID: US 6629926 B1

L45: Entry 4 of 24 File: USPT Oct 7, 2003

US-PAT-NO: 6629926
DOCUMENT-IDENTIFIER: US 6629926 B1

TITLE: Ultrasonic system and method for storing data

DATE-ISSUED: October 7, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		
Guracar; Ismayil M.	Redwood City	CA		
Fash, III; D. Grant	Saratoga	CA		
Shakouri; Shahrokh	San Jose	CA		

US-CL-CURRENT: 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

5. Document ID: US 6587540 B1

L45: Entry 5 of 24 File: USPT Jul 1, 2003

US-PAT-NO: 6587540
DOCUMENT-IDENTIFIER: US 6587540 B1

TITLE: Apparatus and method for imaging objects with wavefields

DATE-ISSUED: July 1, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT		
Borup; David T.	Salt Lake City	UT		
Wiskin; James	Salt Lake City	UT		
Berggren; Michael J.	Salt Lake City	UT		

US-CL-CURRENT: 378/62; 378/4

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

6. Document ID: US 6490374 B2

L45: Entry 6 of 24 File: USPT Dec 3, 2002

US-PAT-NO: 6490374
DOCUMENT-IDENTIFIER: US 6490374 B2

TITLE: Accelerated signal encoding and reconstruction using pixon method

DATE-ISSUED: December 3, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Puetter; Richard	San Diego	CA		
Yahil; Amos	Stony Brook	NY		

US-CL-CURRENT: 382/265; 382/205, 382/275

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

7. Document ID: US 6417857 B2

L45: Entry 7 of 24 File: USPT Jul 9, 2002

US-PAT-NO: 6417857
DOCUMENT-IDENTIFIER: US 6417857 B2

TITLE: System architecture and method for operating a medical diagnostic ultrasound system

DATE-ISSUED: July 9, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		
Guracar; Ismayil M.	Redwood City	CA		
Fash, III; D. Grant	Saratoga	CA		
Shakouri; Shahrokh	San Jose	CA		

US-CL-CURRENT: 345/505; 600/437, 712/22

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

8. Document ID: US 6393449 B1

L45: Entry 8 of 24 File: USPT May 21, 2002

US-PAT-NO: 6393449
DOCUMENT-IDENTIFIER: US 6393449 B1
**** See image for Certificate of Correction ****

TITLE: Arbitrary function generator

DATE-ISSUED: May 21, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bair; Samuel S.	Dublin	OH		
Jagadeesh; Jogikal M.	Columbus	OH		
Abduljalil; Amir M.	Hilliard	OH		

US-CL-CURRENT: 708/270

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

9. Document ID: US 6385474 B1

L45: Entry 9 of 24 File: USPT May 7, 2002

US-PAT-NO: 6385474
DOCUMENT-IDENTIFIER: US 6385474 B1

TITLE: Method and apparatus for high-resolution detection and characterization of medical pathologies

DATE-ISSUED: May 7, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rather; John D. G.	Grosse Pointe	MI		
Caulfield; H. John	Cornersville	TN		
Doolittle; Richard D.	Bethesda	MD		
Littrup; Peter J.	Bloomfield Hills	MI		
Zeiders; Glenn W.	Huntsville	AL		

US-CL-CURRENT: 600/407; 128/920, 128/924, 128/925, 600/437, 600/438, 600/442, 600/473, 600/476

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

10. Document ID: US 6358204 B1

L45: Entry 10 of 24 File: USPT Mar 19, 2002

US-PAT-NO: 6358204
DOCUMENT-IDENTIFIER: US 6358204 B1

TITLE: Ultrasonic system and method for storing data

DATE-ISSUED: March 19, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		
Guracar; Ismayil M.	Redwood City	CA		
Fash, III; D. Grant	Saratoga	CA		
Shakouri; Shahrokh	San Jose	CA		

US-CL-CURRENT: 600/437; 600/443, 600/447

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

11. Document ID: US 6353688 B1

L45: Entry 11 of 24 File: USPT Mar 5, 2002

US-PAT-NO: 6353688
DOCUMENT-IDENTIFIER: US 6353688 B1

TITLE: Accelerated signal encoding and reconstruction using pixon method

DATE-ISSUED: March 5, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Puetter; Richard	San Diego	CA		

Yahil; Amos Stony Brook NY

US-CL-CURRENT: 382/265; 382/205, 382/270

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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☐ 12. Document ID: US 6320928 B1

L45: Entry 12 of 24 File: USPT Nov 20, 2001

US-PAT-NO: 6320928
DOCUMENT-IDENTIFIER: US 6320928 B1

TITLE: Method of reconstruction of a three-dimensional image of an object

DATE-ISSUED: November 20, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Vaillant; Regis	Villebon sur Yvette			FR
Trousset; Yves	Palaiseau			FR
Boucherie; Romain	Meudon			FR
Romeas; Rene	Palaiseau			FR

US-CL-CURRENT: 378/4; 700/182, 700/98

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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☐ 13. Document ID: US 6300961 B1

L45: Entry 13 of 24 File: USPT Oct 9, 2001

US-PAT-NO: 6300961
DOCUMENT-IDENTIFIER: US 6300961 B1

TITLE: Ultrasonic system and method for processing data

DATE-ISSUED: October 9, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		
Guracar; Ismayil M.	Redwood City	CA		
Fash, III; D. Grant	Saratoga	CA		
Shakouri; Shahrokh	San Jose	CA		

US-CL-CURRENT: 345/505; 345/532, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

14. Document ID: US 6262749 B1

L45: Entry 14 of 24 File: USPT Jul 17, 2001

US-PAT-NO: 6262749
DOCUMENT-IDENTIFIER: US 6262749 B1
**** See image for Certificate of Correction ****

TITLE: Ultrasonic system and method for data transfer, storage and/or processing

DATE-ISSUED: July 17, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		
Guracar; Ismayil M.	Redwood City	CA		
Fash, III; D. Grant	Saratoga	CA		
Shakouri; Shahrokh	San Jose	CA		

US-CL-CURRENT: 345/564; 128/916, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

15. Document ID: US 6236742 B1

L45: Entry 15 of 24 File: USPT May 22, 2001

US-PAT-NO: 6236742
DOCUMENT-IDENTIFIER: US 6236742 B1

TITLE: Coherent superscan early cancer detection

DATE-ISSUED: May 22, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Handel; Peter H.	St. Louis	MO	63121	

US-CL-CURRENT: 382/128; 382/130

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

16. Document ID: US 6171244 B1

L45: Entry 16 of 24 File: USPT Jan 9, 2001

US-PAT-NO: 6171244
DOCUMENT-IDENTIFIER: US 6171244 B1

TITLE: Ultrasonic system and method for storing data

DATE-ISSUED: January 9, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		
Guracar; Ismayil M.	Redwood City	CA		
Fash, III; D. Grant	Saratoga	CA		
Shakouri; Shahrokh	San Jose	CA		

US-CL-CURRENT: 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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17. Document ID: US 6130958 A

L45: Entry 17 of 24 File: USPT Oct 10, 2000

US-PAT-NO: 6130958
DOCUMENT-IDENTIFIER: US 6130958 A

TITLE: Method for reconstructing the image of an object scanned with a laser imaging apparatus

DATE-ISSUED: October 10, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rohler; David P.	University Heights	OH		
Kasibhatla; Sastry L. A.	University Heights	OH		
Ross; Steven	Boca Raton	FL		

US-CL-CURRENT: 382/131; 250/339.06, 359/27, 359/32, 378/37, 382/255, 600/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

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18. Document ID: US 6005916 A

L45: Entry 18 of 24 File: USPT Dec 21, 1999

US-PAT-NO: 6005916
DOCUMENT-IDENTIFIER: US 6005916 A
**** See image for Certificate of Correction ****

TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

DATE-ISSUED: December 21, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT		
Borup; David T.	Salt Lake City	UT		
Wiskin; James W.	Salt Lake City	UT		
Natterer; Frank	Muenster			DE
Wubeling; F.	Muenster			DE
Zhang; Yongzhi	Madison	WI		
Olsen; Scott Charles	Salt Lake City	UT		

US-CL-CURRENT: 378/87; 378/98, 600/425, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. De

19. Document ID: US 5971923 A

L45: Entry 19 of 24 File: USPT Oct 26, 1999

US-PAT-NO: 5971923
DOCUMENT-IDENTIFIER: US 5971923 A
**** See image for Certificate of Correction ****

TITLE: Ultrasound system and method for interfacing with peripherals

DATE-ISSUED: October 26, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Finger; David J.	San Jose	CA		

US-CL-CURRENT: 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. De

20. Document ID: US 5936233 A

L45: Entry 20 of 24 File: USPT Aug 10, 1999

US-PAT-NO: 5936233
DOCUMENT-IDENTIFIER: US 5936233 A

TITLE: Buried object detection and neutralization system

DATE-ISSUED: August 10, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nunnally; William C.	Columbia	MO		

US-CL-CURRENT: 250/221; 250/222.1, 342/76

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

21. Document ID: US 5931789 A

L45: Entry 21 of 24 File: USPT Aug 3, 1999

US-PAT-NO: 5931789
DOCUMENT-IDENTIFIER: US 5931789 A

TITLE: Time-resolved diffusion tomographic 2D and 3D imaging in highly scattering turbid media

DATE-ISSUED: August 3, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Alfano; Robert R.	Bronx	NY		
Cai; Wei	Bronx	NY		
Liu; Feng	Bronx	NY		
Lax; Melvin	Summit	NJ		
Das; Bidyut B.	Flushing	NY		

US-CL-CURRENT: 600/473; 356/432, 600/310, 600/476

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

22. Document ID: US 5588032 A

L45: Entry 22 of 24 File: USPT Dec 24, 1996

US-PAT-NO: 5588032
DOCUMENT-IDENTIFIER: US 5588032 A

TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

DATE-ISSUED: December 24, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT	84108	
Wiskin; James W.	Salt Lake City	UT	84112	
Borup; David T.	Salt Lake City	UT	84103	
Christensen; Douglas A.	Salt Lake City	UT	84121	
Stenger; Frank	Salt Lake City	UT	84103	

US-CL-CURRENT: 378/8; 378/90, 378/901, 378/98, 702/1

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 23. Document ID: US 6587540 B1

L45: Entry 23 of 24 File: DWPI Jul 1, 2003

DERWENT-ACC-NO: 2003-554759
DERWENT-WEEK: 200352

TITLE: Inverse scattering imaging method for use in e.g. medical diagnosis by setting average spatial separation of points used to discrete wave field to be one half of wavelength in imbedding component

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 24. Document ID: US 5588032 A

L45: Entry 24 of 24 File: DWPI Dec 24, 1996

DERWENT-ACC-NO: 1997-065046
DERWENT-WEEK: 200352

TITLE: Producing scattering-potential image of object from e.g. EM, elastic or acoustic wave-field energy scattered by object - using CPU to perform convergence for each frequency of scattering potential of object, using Green's function and Jacobian of calculated scattered field, convergence step being repeated until required tolerance is obtained

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Term	Documents
MEDICAL	402826
MEDICALS	518
MRI	22062
MRIS	291
NMR	129054
NMRS	211
MAGNETIC	1386825
MAGNETICS	11747
RESONANCE	268796
RESONANCES	15408

(L44 AND (MEDICAL OR DIAGNOSTIC$5 OR MRI OR NMR OR (MAGNETIC ADJ RESONANCE))).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	24

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☑ 1. Document ID: US 6321111 B1

Using default format because multiple data bases are involved.

L43: Entry 1 of 9 File: USPT Nov 20, 2001

US-PAT-NO: 6321111
DOCUMENT-IDENTIFIER: US 6321111 B1

TITLE: Optical imaging using time gated scattered light

DATE-ISSUED: November 20, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Perelman; Lev T.	Malden	MA		
Wu; Jun	Cambridge	MA		
Wang; Yang	Sommervile	MA		
Dasari; Ramachandra Rac	Lexington	MA		
Itzkan; Irving	Boston	MA		
Feld; Michael S.	Newton	MA		

US-CL-CURRENT: 600/477; 250/358.1, 250/458.1

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw D

☐ 2. Document ID: US 6006175 A

L43: Entry 2 of 9 File: USPT Dec 21, 1999

US-PAT-NO: 6006175
DOCUMENT-IDENTIFIER: US 6006175 A

TITLE: Methods and apparatus for non-acoustic speech characterization and recognition

DATE-ISSUED: December 21, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Holzrichter; John F.	Berkeley	CA		

US-CL-CURRENT: 704/208; 704/205, 704/206, 704/207

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

3. Document ID: US 6005916 A

L43: Entry 3 of 9 File: USPT Dec 21, 1999

US-PAT-NO: 6005916
DOCUMENT-IDENTIFIER: US 6005916 A
**** See image for Certificate of Correction ****

TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

DATE-ISSUED: December 21, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT		
Borup; David T.	Salt Lake City	UT		
Wiskin; James W.	Salt Lake City	UT		
Natterer; Frank	Muenster			DE
Wubeling; F.	Muenster			DE
Zhang; Yongzhi	Madison	WI		
Olsen; Scott Charles	Salt Lake City	UT		

US-CL-CURRENT: 378/87; 378/98, 600/425, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

4. Document ID: US 5919140 A

L43: Entry 4 of 9 File: USPT Jul 6, 1999

US-PAT-NO: 5919140
DOCUMENT-IDENTIFIER: US 5919140 A

TITLE: Optical imaging using time gated scattered light

DATE-ISSUED: July 6, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Perelman; Lev T.	Malden	MA		
Wu; Jun	Cambridge	MA		
Wang; Yang	Sommervile	MA		
Dasari; Ramachandra Rao	Lexington	MA		
Itzkan; Irving	Boston	MA		

Feld; Michael S.	Newton	MA

US-CL-CURRENT: 600/476; 600/310, 606/3, 607/88

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

5. Document ID: US 5892900 A

L43: Entry 5 of 9 File: USPT Apr 6, 1999

US-PAT-NO: 5892900
DOCUMENT-IDENTIFIER: US 5892900 A
**** See image for Certificate of Correction ****

TITLE: Systems and methods for secure transaction management and electronic rights protection

DATE-ISSUED: April 6, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ginter; Karl L.	Beltsville	MD		
Shear; Victor H.	Bethesda	MD		
Sibert; W. Olin	Lexington	MA		
Spahn; Francis J.	El Cerrito	CA		
Van Wie; David M.	Sunnyvale	CA		

US-CL-CURRENT: 713/200; 713/201

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

6. Document ID: US 5588032 A

L43: Entry 6 of 9 File: USPT Dec 24, 1996

US-PAT-NO: 5588032
DOCUMENT-IDENTIFIER: US 5588032 A

TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

DATE-ISSUED: December 24, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT	84108	
Wiskin; James W.	Salt Lake City	UT	84112	
Borup; David T.	Salt Lake City	UT	84103	
Christensen; Douglas A.	Salt Lake City	UT	84121	
Stenger; Frank	Salt Lake City	UT	84103	

US-CL-CURRENT: 378/8; 378/90, 378/901, 378/98, 702/1

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

7. Document ID: US 5573012 A

L43: Entry 7 of 9 File: USPT Nov 12, 1996

US-PAT-NO: 5573012
DOCUMENT-IDENTIFIER: US 5573012 A

TITLE: Body monitoring and imaging apparatus and method

DATE-ISSUED: November 12, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
McEwan; Thomas E.	Livermore	CA		

US-CL-CURRENT: 600/595; 600/428, 600/534

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

8. Document ID: US 5227797 A

L43: Entry 8 of 9 File: USPT Jul 13, 1993

US-PAT-NO: 5227797
DOCUMENT-IDENTIFIER: US 5227797 A

TITLE: Radar tomography

DATE-ISSUED: July 13, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Murphy; Quentin M.	Bronxville	NY	10708	

US-CL-CURRENT: 342/22; 600/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

9. Document ID: EP 395015 A, DE 69023536 E, CA 2014833 A, US 5030956 A, US 5227797 A, EP 395015 B1

L43: Entry 9 of 9 File: DWPI Oct 31, 1990

DERWENT-ACC-NO: 1990-329047
DERWENT-WEEK: 199605

TITLE: Radar tomography appts. for medical imaging - receives reflected radar pulses which correspond to emitted pulses reflected from patient

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. D

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Term	Documents
MEDICAL	402826
MEDICALS	518
MRI	22062
MRIS	291
NMR	129054
NMRS	211
MAGNETIC	1386825
MAGNETICS	11747
RESONANCE	268796
RESONANCES	15408
(L42 AND (MEDICAL OR DIAGNOSTIC$5 OR MRI OR NMR OR (MAGNETIC ADJ RESONANCE))).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	9

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Search Results - Record(s) 1 through 10 of 10 returned.

1. Document ID: US 6705990 B1

Using default format because multiple data bases are involved.

L41: Entry 1 of 10 File: USPT Mar 16, 2004

US-PAT-NO: 6705990
DOCUMENT-IDENTIFIER: US 6705990 B1

TITLE: Method and apparatus for monitoring physiologic parameters of a living subject

DATE-ISSUED: March 16, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Gallant; Stuart L.	San Diego	CA		
Markle; William H.	Laguna Nigel	CA		

US-CL-CURRENT: 600/300; 128/903, 128/904, 600/485, 600/490, 600/500

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

2. Document ID: US 6554774 B1

L41: Entry 2 of 10 File: USPT Apr 29, 2003

US-PAT-NO: 6554774
DOCUMENT-IDENTIFIER: US 6554774 B1

TITLE: Method and apparatus for assessing hemodynamic properties within the circulatory system of a living subject

DATE-ISSUED: April 29, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Miele; Frank R.	Methuen	MA		

US-CL-CURRENT: 600/485; 600/490, 600/500, 600/504

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 3. Document ID: US 6514211 B1

L41: Entry 3 of 10 File: USPT Feb 4, 2003

US-PAT-NO: 6514211
DOCUMENT-IDENTIFIER: US 6514211 B1

TITLE: Method and apparatus for the noninvasive determination of arterial blood pressure

DATE-ISSUED: February 4, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Baura; Gail D.	San Diego	CA		

US-CL-CURRENT: 600/490; 600/485, 600/500

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 4. Document ID: US 6471655 B1

L41: Entry 4 of 10 File: USPT Oct 29, 2002

US-PAT-NO: 6471655
DOCUMENT-IDENTIFIER: US 6471655 B1
**** See image for Certificate of Correction ****

TITLE: Method and apparatus for the noninvasive determination of arterial blood pressure

DATE-ISSUED: October 29, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Baura; Gail D.	San Diego	CA		

US-CL-CURRENT: 600/485; 600/500

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 5. Document ID: US 6006175 A

L41: Entry 5 of 10 File: USPT Dec 21, 1999

US-PAT-NO: 6006175
DOCUMENT-IDENTIFIER: US 6006175 A

TITLE: Methods and apparatus for non-acoustic speech characterization and

recognition

DATE-ISSUED: December 21, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Holzrichter; John F.	Berkeley	CA		

US-CL-CURRENT: 704/208; 704/205, 704/206, 704/207

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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6. Document ID: US 5647360 A

L41: Entry 6 of 10 File: USPT Jul 15, 1997

US-PAT-NO: 5647360
DOCUMENT-IDENTIFIER: US 5647360 A

TITLE: Digital subtraction angiography for 3D diagnostic imaging

DATE-ISSUED: July 15, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bani-Hashemi; Ali Reza	Belle Mead	NJ		
Samaddar; Sumitro	Plainsboro	NJ		
Hentschel; Dietmar	Little Silver	NJ		

US-CL-CURRENT: 600/425; 382/130, 600/431, 600/508

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

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7. Document ID: US 5573012 A

L41: Entry 7 of 10 File: USPT Nov 12, 1996

US-PAT-NO: 5573012
DOCUMENT-IDENTIFIER: US 5573012 A

TITLE: Body monitoring and imaging apparatus and method

DATE-ISSUED: November 12, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
McEwan; Thomas E.	Livermore	CA		

US-CL-CURRENT: 600/595; 600/428, 600/534

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

8. Document ID: US 5227797 A
L41: Entry 8 of 10 File: USPT Jul 13, 1993

US-PAT-NO: 5227797
DOCUMENT-IDENTIFIER: US 5227797 A

TITLE: Radar tomography

DATE-ISSUED: July 13, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Murphy; Quentin M.	Bronxville	NY	10708	

US-CL-CURRENT: 342/22; 600/425

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

9. Document ID: US 5030956 A
L41: Entry 9 of 10 File: USPT Jul 9, 1991

US-PAT-NO: 5030956
DOCUMENT-IDENTIFIER: US 5030956 A
**** See image for Certificate of Correction ****

TITLE: Radar tomography

DATE-ISSUED: July 9, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Murphy; Quentin M.	Bronxville	NY	10708	

US-CL-CURRENT: 342/22; 433/25, 600/428, 600/430, 600/590

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

10. Document ID: EP 395015 A, DE 69023536 E, CA 2014833 A, US 5030956 A, US 5227797 A, EP 395015 B1
L41: Entry 10 of 10 File: DWPI Oct 31, 1990

DERWENT-ACC-NO: 1990-329047
DERWENT-WEEK: 199605

TITLE: Radar tomography appts. for medical imaging - receives reflected radar pulses which correspond to emitted pulses reflected from patient

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Term	Documents
MEDICAL	402826
MEDICALS	518
MRI	22062
MRIS	291
NMR	129054
NMRS	211
MAGNETIC	1386825
MAGNETICS	11747
RESONANCE	268796
RESONANCES	15408
(L40 AND (MEDICAL OR DIAGNOSTIC$5 OR MRI OR NMR OR (MAGNETIC ADJ RESONANCE))).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	10

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Search Results - Record(s) 1 through 1 of 1 returned.

☐ 1. Document ID: US 6005916 A

Using default format because multiple data bases are involved.

L29: Entry 1 of 1   File: USPT   Dec 21, 1999

US-PAT-NO: 6005916
DOCUMENT-IDENTIFIER: US 6005916 A
**** See image for Certificate of Correction ****

TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

DATE-ISSUED: December 21, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT		
Borup; David T.	Salt Lake City	UT		
Wiskin; James W.	Salt Lake City	UT		
Natterer; Frank	Muenster			DE
Wubeling; F.	Muenster			DE
Zhang; Yongzhi	Madison	WI		
Olsen; Scott Charles	Salt Lake City	UT		

US-CL-CURRENT: 378/87; 378/98, 600/425, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Term	Documents
MEDICAL	402826
MEDICALS	518
MRI	22062
MRIS	291
NMR	129054
NMRS	211

MAGNETIC	1386825
MAGNETICS	11747
RESONANCE	268796
RESONANCES	15408
(28 AND (MRI OR (MAGNETIC ADJ RESONANCE) OR MEDICAL OR NMR)).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	1
(L28 AND (MEDICAL OR MRI OR NMR OR (MAGNETIC ADJ RESONANCE))).PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD.	1

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First Hit Fwd Refs
End of Result Set

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L37: Entry 6 of 6 File: USPT Dec 21, 1999

DOCUMENT-IDENTIFIER: US 6005916 A
**** See image for Certificate of Correction ****
TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

Brief Summary Text (8):
Other imaging methods have been applied to one or the other modality, or restricted to acoustic or elastic media, the method described in this patent is applicable to any type of wave motion, whether electromagnetic, elastic (including shear wave effects) or acoustic (scalar approximation valid in liquid and gases). Furthermore, the ambient media may have some forms of structure (layering) or microstructure (porosity) relevant to the medical, geophysical, or nondestructive imaging applications envisioned for this technology. In the prior art the presence of this layering or porosity has greatly diminished the effectiveness of the imaging program. The method of this patent minimizes the obscuring effect of such structures in the ambient media. In addition, we have made several changes to the previous U.S. Pat. No. 4,662,222 that significantly extend the applicability and speed of our algorithm. These changes are described, in part, below:

Brief Summary Text (25):
Although similar techniques have appeared in the scientific literature as theory only or in algorithms that, due to lack of efficiency, cannot handle problems of practical size, these methods are substantially different from other algorithms that cannot be used in a practical imaging device such as Diffraction Tomography, Colton and Monk's method. Although some of the methods introduced by Borup, Johnson, Wiskin, and co-workers were available earlier, other factors had to come together before the present apparatus and method become applicable to concrete problems in medical imaging, geophysical imaging, and nondestructive imaging (NDI) in layered and porous media.

Brief Summary Text (27):
This observation is supported by the fact that although there has been a pressing need for high resolution imaging technology for several decades in the medical, NDI and geophysical fields, there has never been, until now, a successful implementation capable of solving practical problems. In particular

Brief Summary Text (32):
A. breast scanners, medical imaging

Brief Summary Text (45):
This generalization of the free space Green's function to this new type of environment was certainly known to be possible in theory. The true difficulty lay in the ability to construct the inverse scattering algorithm and Green's function in such a way that "convolution" is preserved, since it is the convolutional character that allows the use of the Fast Fourier Transform (FFT), which in turn makes the imaging process practical for the medical/geophysical/Nondestructive Evaluation (NDE) scanners mentioned above. (Actually it is convolution/correlation which is preserved, however, the correlation is accomplished by turning it into a

convolution via a mathematical transformation.) It is this convolution property that enables us to perform the inversion with such unusual speed. There are several non-trivial changes to the flowcharts that must be made in order to accommodate the effects of the layering, these changes are shown below in the accompanying flowcharts.

Brief Summary Text (53):
5. The examples given in this patent all assume that the different frequencies, .omega., and source positions, .phi., are all computed in serial fashion. It is important to note, however, that another important link in the real time implementation of our algorithm, is the fact that the different frequencies and different views are independent computations (in both the forward problem and Jacobian calculations), and therefore can be computed in parallel. The implementation of this parallelization is explained in detail below. The omission of any one of these important links renders the algorithm intolerably slow for the practical medical/geophysical/NDE scanners listed above.

Brief Summary Text (57):
Electromagnetic Medical Imaging

Brief Summary Text (63):
11. Furthermore, all the advantages over state of the art discussed in the previous patent remain in the present one, and with the additional improvements enumerated above. The speed up of the imaging process, even though it covers several orders of magnitude, does not result from any degradation in image quality, just as discussed in the previous patent. Virtually all the quantitative tissue characterization capabilities of the previous algorithm are retained in the present case, with its substantial improvement over the B-scanners presently in use for medical diagnostic imaging.

Brief Summary Text (68):
It is very important to note that these calculations do not make any use of the parallelizability of our methods and hardware. The implementation of the simple-minded parallelization discussed in this patent results in an immediate speedup of 10 to 100 times, allowing us to do much larger problems in minutes versus the 8 hours required by the conventional approaches. This is very rough, however, the simple calculation above supports our claim that our methods far surpass present technology in wave-field imaging. The 100 by 100 problem is large enough to be practical for applications in medical technology, geophysical imaging, non-destructive testing, and environmental imaging that require a high degree of resolution in real time. For those situations that require the application of multiple frequencies (such as multiparameter imaging, and such as for reflection mode imaging) a smaller edge dimension is called for, however, the resolution achievable with our technology is much greater than present state of the art.

Brief Summary Text (598):
The scientific background to the phase aberration correction based upon the brightness functional is simply that the L.sub.2 norm (functional) of the B-scan image intensity is maximized when the phase shifts (time delays) are such that the image is maximally focused [L. Nock and G. E. Trahey, "Phase aberration correction in medical ultrasound using speckle brightness as a quality factor," Journ. Acoustical Society of America, 1989, 85, 1819-1833, herein included as reference].

Drawing Description Text (45):
FIGS. 28A/B, 29A-29E are photographs of a television display screen showing an image that simulates a cancer and an active image obtained as the inverse scattering solution using the method and a computer simulation of the apparatus of the present invention.

Detailed Description Text (2):

The apparatus and method of the present invention holds promise for many useful applications in various fields, including seismic surveying, nondestructive testing, sonar, radar, ground penetrating radar, optical microscopes, x-ray microscopes, and medical ultrasound imaging, to name just a few. For purposes of illustrating the utility of the present invention, the detailed description which follows will emphasize the apparatus and method of the invention in the context of a system for use in performing ultrasound imaging of human organs, such as the breast. However, it will be appreciated that the present invention as claimed herein may employ other forms of energy such as microwaves, light or elastic waves and furthermore may be used in other fields and is not intended to be limited solely to medical acoustic imaging.

Detailed Description Text (4):
Reference is first made to FIG. 1 which generally illustrates one type of scanner which may be used to implement the apparatus and method of the present invention for purposes of medical ultrasound imaging of a human breast or other organs. As shown in FIG. 1, the scanning apparatus generally designated at 30 includes fixed base 32. Wheels 38 and 40 are attached to the underside of a movable carriage base 34. Small shoulders 42-45 formed on the upper surface of cylindrical pedestal 36 define a track along which the wheels 38 and 40 are guided.

Detailed Description Text (38):
Such one-dimensional and two-dimensional arrays of receivers and transmitters have a direct application to advanced medical imaging instruments where motion of the array is undesirable or in seismic exploration in which such movements are difficult. FIG. 4E illustrates how each element 131a through 131n may be switched to either a transmitter circuit or a receiver circuit. Here, for example, element 131a is switched by switch 137a to either a receiver circuit 133a or a transmitter circuit 135a. FIG. 4F shows how a passive network of diodes and resistors may be used to allow a single element to act as either a transmitter or a receiver, or in both capacities. For example, in the transmit mode, diodes 139 are driven into conduction by transmit signal on line 135a. With two silicon diodes in series in each parallel leg, the voltage drop is a few volts. Thus, for an applied transmit signal of 20 volt or more, only a small percentage of signal power is lost across diodes 139. Diodes 139 are arranged in a series parallel network so that either polarity of signal is passed to transducer element 131a with negligible loss. In the transmit mode, resistors 145, 147, and 149 and diodes 141 and 143 prevent excessive and harmful voltage from appearing at output 133a that leads to the preamplifier multiplexer, or analog-to-digital circuits that follow. In operation, resistor 145, diode 141, and resistor 149 act as a voltage divider for the large transmit voltage present at the transducer element 131a. Diodes 141 are arranged with opposing polarity to provide a path for any polarity of signal above their turn on voltage of about 0.7 to 1.0 volts. The values of resistors 145 and 149 are typically so that the impedance of resistor 145 is greater than or equal to that of the internal impedance of transducer element 131a. Resistor 149 is chosen to be some fraction of resistor 145, such as one-fifth. Resistor (resistor 147) typically is chosen to be about equal to the resistance of resistor 149. Thus,during transmission, the voltage appearing at output 133a is only the conduction voltage drop across diodes 143.

Detailed Description Text (85):
It is also important to note that all of the Appendices, with the exclusion of Appendix D, deal with the rectangular iterative method. Appendix D in distinction deals with the two-dimensional cylindrical recursion method for solving the forward problems in less time than the rectangular recursion method for Gauss-Newton iteration. It is also important to recognize that the construction of the layered Green's function as shown in Summary of the Invention, Example 2 shows explicitly how the convolution and correlation are preserved even though the distribution of the layers above and below the layer containing the image space are arbitrarily distributed. The preservation of convolution and correlation is a critical element

of the ability to image objects in a layered or Biot environment (Biot referring to the Biot theory of wave propagation in porous media) in real time. The reflection coefficients which are used in the construction of the layered Green's function in the acoustic, elastic and the electromagnetic case are well known in the literature. See, for example [Muller, 1985] or Aki and Richards, 1980. The incorporation of this Green's function for layered media in the acoustic, elastic and electromagnetic case for the express purpose of imaging objects buried within such a layered medium is novel. The ability to image in real time is critical to practical application of this technology in the medical, geophysical, non-destructive and testing microscopic environments.

Detailed Description Text (110):
FIGS. 28A and 28B show an example of the application of inverse scattering to medical imaging through the use of computer simulation. FIGS. 28A and 28B also illustrate the powerful impact of a large inverse scattering image. FIG. 28A is a photograph of a cross section of a human through the abdomen that could appear in an anatomy atlas. The image was actually made on a magnetic resonance clinical scanner. This image is 200 by 200 pixels, each pixel being 1/4 wave length square. It was used a the starting image in the process of creating synthetic scattering data. The pixel values in this image were assigned to a set of speed of sound values in a range that is typical for soft tissue. This range is typically plus or minus 5 percent of the speed of sound of water. Using this image of speed of sound the forward scattering algorithm then computed the scattered field at a set of detectors on the perimeter of the image for the case of incident plane waves for 200 source directions equally spaced in angle around 360 degrees. The detectors enclosed the cross section on all sides and numbered 4(200).times.4=796. This set of synthetic scattering data was used to compute the inverse scattering image of FIG. 28B.

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☐	L44	5588032	31
☐	L43	L42 and (medical or diagnostic$5 or MRI or NMR or (magnetic adj resonance))	9
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☐	L38	5227797	19
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☐	L35	6005916	14
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☐	L33	L24 and (security or screen$4 or airport or luggage or wand$4 or baton)	37
☐	L32	L31 and (medical or MRI or NMR or (magnetic adj resonance))	0
☐	L31	L24 and (security or screening or airport or luggage or wand$4 or baton)	16
☐	L30	(4622222| 4727550| 4798209| 5227797| 5588032| 5667893)![pn]	12
☐	L29	L28 and (medical or MRI or NMR or (magnetic adj resonance))	1
☐	L28	L27 and (aperature or opening or hole)	22
☐	L27	L26 and (map or mapping or mapped or identify$4 or identification or identified or identity or determin$7)	60
☐	L26	L25 and (spatial$3 or space or spaced or spacing)	64
☐	L25	L24 and (planar or slice or plane or slab)	64
☐	L24	L23 or l17	73
☐	L23	L22 and ((beam$4 or ray or wave or wavelength or wave-length or "wave length" or "lamda") with (transmit$4 or absorb$4 or non-reflect$3 or emit$4 or attenuat$5))	56
☐	L22	L20 and ((beam$4 or ray or wave or wavelength or wave-length or "wave length" or "lamda") with ((radio adj frequency) or RF or radio-frequency))	60
		L20 and ((beam or ray or wave or wavelength or wave-length or "wave	

☐	L21	length" or "lamda") with ((radio adj frequency) or RF or radio-frequency))	59
☐	L20	L19 and (internal$3 or inside or "within" or inner)	164
☐	L19	L18 and (intersect$6 or interact$4 or perpendicula$3 or orthogonal$3)	168
☐	L18	L12 and (security or screening or airport or luggage or wand$4 or baton or people or object or subject or patient)	201
☐	L17	L16 and ((beam or ray or wave or wavelength or wave-length or "wave length" or "lamda") with (transmit$4 or absorb$4 or non-reflect$3 or emit$4 or attenuat$5))	72
☐	L16	L15 and ((beam or ray or wave or wavelength or wave-length or "wave length" or "lamda") with ((radio adj frequency) or RF or radio-frequency))	77
☐	L15	L13 and (internal$3 or inside or "within" or inner)	186
☐	L14	L13 and (intersect$6 or interact$4 or perpendicula$3 or orthogonal$3)	159
☐	L13	L12 and (security or screening or airport or luggage or wnad$4 or baton or people or object or subject or patient)	192
☐	L12	L11 and (detect$4 or sens$4 or receiv$4 or reception)	218
☐	L11	L10 and (power$5)	220
☐	L10	L9 and (move or moving or movement or moved or motion or travel$4 or path or trajector$4 or rotat$4 or tip$4 or flip$4 nutat$4 or rotational$2)	256
☐	L9	L8 and (image or imaging or imaged or scan$5 or tomography or tomographic$5)	262
☐	L8	L7 and (waveguid$4 or wave-guid$4 or "wave guid$4" or (horn with antenn$2) or (cassegrain with antennn$2))	441
☐	L7	L6 and ((parabolic$4 or parabola) with (reflect$4 or antenn$2))	1138
☐	L6	L5 and (axis or axes or axial$2 or azimuth$4 or angle)	29671
☐	L5	L4 and (cross or attenuat$5)	47240
☐	L4	L3 and (beam or ray or wave or wavelength or wave-length or "wave length" or "lamda")	82915
☐	L3	L2 and (signal or puls$3)	146274
☐	L2	L1 and (transmit$4 or absorb$4 or non-reflect$3 or emit$4)	185999
☐	L1	((radio adj frequency) or RF or radio-frequency)	346818

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☐ 1. Document ID: US 6603134 B1

Using default format because multiple data bases are involved.

L28: Entry 1 of 22 File: USPT Aug 5, 2003

US-PAT-NO: 6603134
DOCUMENT-IDENTIFIER: US 6603134 B1

TITLE: Optical detection system

DATE-ISSUED: August 5, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Wild; Norman R.	Nashua	NH		
Leavy, Jr.; Paul M.	Lynnfield	MA		

US-CL-CURRENT: 250/526; 250/342, 89/1.11

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 2. Document ID: US 6005916 A

L28: Entry 2 of 22 File: USPT Dec 21, 1999

US-PAT-NO: 6005916
DOCUMENT-IDENTIFIER: US 6005916 A
**** See image for Certificate of Correction ****

TITLE: Apparatus and method for imaging with wavefields using inverse scattering techniques

DATE-ISSUED: December 21, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Johnson; Steven A.	Salt Lake City	UT		
Borup; David T.	Salt Lake City	UT		
Wiskin; James W.	Salt Lake City	UT		
Natterer; Frank	Muenster			DE
Wubeling; F.	Muenster			DE

Zhang; Yongzhi	Madison	WI
Olsen; Scott Charles	Salt Lake City	UT

US-CL-CURRENT: 378/87; 378/98, 600/425, 600/437

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

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3. Document ID: US 5859619 A

L28: Entry 3 of 22 File: USPT Jan 12, 1999

US-PAT-NO: 5859619
DOCUMENT-IDENTIFIER: US 5859619 A

TITLE: Small volume dual offset reflector antenna

DATE-ISSUED: January 12, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Wu; Te-Kao	Rancho Palos Verdes	CA		
Yee; Benny	Monterey Park	CA		
Simkins; George H.	Torrance	CA		

US-CL-CURRENT: 343/781CA; 343/781P, 343/840

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

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4. Document ID: US 5495258 A

L28: Entry 4 of 22 File: USPT Feb 27, 1996

US-PAT-NO: 5495258
DOCUMENT-IDENTIFIER: US 5495258 A

TITLE: Multiple beam antenna system for simultaneously receiving multiple satellite signals

DATE-ISSUED: February 27, 1996

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Muhlhauser; Nicholas L.	Los Gatos	CA	95030	
Townley; Scott A.	Gilbert	AZ		
Weakley; Thomas C.	Los Gatos	CA		

US-CL-CURRENT: 343/753; 343/853, 343/895

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KMC | Draw De

5. Document ID: US 5327149 A
L28: Entry 5 of 22 File: USPT Jul 5, 1994

US-PAT-NO: 5327149
DOCUMENT-IDENTIFIER: US 5327149 A

TITLE: R.F. transparent RF/UV-IR detector apparatus

DATE-ISSUED: July 5, 1994

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Kuffer; Fernand B.	Brea	CA		

US-CL-CURRENT: 343/720; 342/53, 343/725, 343/781CA

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

6. Document ID: US 5214438 A
L28: Entry 6 of 22 File: USPT May 25, 1993

US-PAT-NO: 5214438
DOCUMENT-IDENTIFIER: US 5214438 A

TITLE: Millimeter wave and infrared sensor in a common receiving aperture

DATE-ISSUED: May 25, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Brusgard; Thomas C.	Riva	MD		
McCormick; Thomas C.	Linthicum	MD		
Sijgers; Hendrik K.	Reston	VA		
Smith; Corbitt T.	Manhattan Beach	CA		
Winterble; William C.	Columbia	MD		
Schwerdt; Christopher B.	Cattonsville	MD		

US-CL-CURRENT: 343/725; 343/781CA, 343/786

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw De

7. Document ID: US 5041840 A
L28: Entry 7 of 22 File: USPT Aug 20, 1991

US-PAT-NO: 5041840

DOCUMENT-IDENTIFIER: US 5041840 A

TITLE: Multiple frequency antenna feed

DATE-ISSUED: August 20, 1991

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cipolla; Frank	Simi Valley	CA	93065	
Sarcione; Michael	Millbury	MA	01527	
Upton; Jeffrey	Acton	MA	01720	
VanWyck; Barry	Billerica	MA	01821	

US-CL-CURRENT: 343/725; 343/700MS, 343/781R, 343/786

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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8. Document ID: US 4879711 A

L28: Entry 8 of 22 File: USPT Nov 7, 1989

US-PAT-NO: 4879711
DOCUMENT-IDENTIFIER: US 4879711 A

TITLE: Satellite communications system employing frequency reuse

DATE-ISSUED: November 7, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rosen; Harold A.	Santa Monica	CA		

US-CL-CURRENT: 370/325

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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9. Document ID: US 4831619 A

L28: Entry 9 of 22 File: USPT May 16, 1989

US-PAT-NO: 4831619
DOCUMENT-IDENTIFIER: US 4831619 A

TITLE: Satellite communications system having multiple downlink beams powered by pooled transmitters

DATE-ISSUED: May 16, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY

Rosen; Harold A.	Santa Monica	CA

US-CL-CURRENT: 370/325; 330/124R, 370/316, 455/13.3

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 10. Document ID: US 4827268 A

L28: Entry 10 of 22 File: USPT May 2, 1989

US-PAT-NO: 4827268
DOCUMENT-IDENTIFIER: US 4827268 A

TITLE: Beam-forming network

DATE-ISSUED: May 2, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rosen; Harold A.	Santa Monica	CA		

US-CL-CURRENT: 342/368; 342/354, 342/356

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 11. Document ID: US 4823341 A

L28: Entry 11 of 22 File: USPT Apr 18, 1989

US-PAT-NO: 4823341
DOCUMENT-IDENTIFIER: US 4823341 A

TITLE: Satellite communications system having frequency addressable high gain downlink beams

DATE-ISSUED: April 18, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rosen; Harold A.	Santa Monica	CA		

US-CL-CURRENT: 370/325; 370/343, 370/497, 455/13.3

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

☐ 12. Document ID: US 4819227 A

L28: Entry 12 of 22 File: USPT Apr 4, 1989

US-PAT-NO: 4819227
DOCUMENT-IDENTIFIER: US 4819227 A

TITLE: Satellite communications system employing frequency reuse

DATE-ISSUED: April 4, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Rosen; Harold A.	Santa Monica	CA		

US-CL-CURRENT: 370/325; 455/13.3

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. D

☐ 13. Document ID: US 4342033 A

L28: Entry 13 of 22 File: USPT Jul 27, 1982

US-PAT-NO: 4342033
DOCUMENT-IDENTIFIER: US 4342033 A

TITLE: Wave action device for radio frequencies

DATE-ISSUED: July 27, 1982

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
de Camargo; Luiz M. V.	Rio de Janeiro, RJ			BR

US-CL-CURRENT: 343/753; 343/909

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. D

☐ 14. Document ID: US 4045724 A

L28: Entry 14 of 22 File: USPT Aug 30, 1977

US-PAT-NO: 4045724
DOCUMENT-IDENTIFIER: US 4045724 A

TITLE: Electromagnetic wave method for mapping subterranean earth formations

DATE-ISSUED: August 30, 1977

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Shuck; Lowell Z.	Morgantown	WV		
Fasching; George E.	Morgantown	WV		
Balanis; Constantine A.	Morgantown	WV		

US-CL-CURRENT: 324/338

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. De

15. Document ID: US 3879732 A

L28: Entry 15 of 22 File: USPT Apr 22, 1975

US-PAT-NO: 3879732
DOCUMENT-IDENTIFIER: US 3879732 A

TITLE: MULTI-DIRECTIONAL BARRAGE JAMMING SYSTEM

DATE-ISSUED: April 22, 1975

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Simpson; Murray	Garden City	NY		

US-CL-CURRENT: 342/14

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. De

16. Document ID: US 3605100 A

L28: Entry 16 of 22 File: USPT Sep 14, 1971

US-PAT-NO: 3605100
DOCUMENT-IDENTIFIER: US 3605100 A

TITLE: ELECTRICALLY SCANNED TRACKING FEED

DATE-ISSUED: September 14, 1971

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Parad; Leonard I.	Framingham	MA		

US-CL-CURRENT: 343/777; 342/371

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw. De

17. Document ID: US RE28217 E

L28: Entry 17 of 22 File: USOC Oct 29, 1974

US-PAT-NO: RE28217
DOCUMENT-IDENTIFIER: US RE28217 E

TITLE: OCR SCANNED DOCUMENT

DATE-ISSUED: October 29, 1974

INVENTOR-NAME: Name not available

US-CL-CURRENT: 343/754; 342/376, 342/377, 343/778

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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18. Document ID: US 3130945 A

L28: Entry 18 of 22 File: USOC Apr 28, 1964

US-PAT-NO: 3130945
DOCUMENT-IDENTIFIER: US 3130945 A

TITLE: Ionocraft

DATE-ISSUED: April 28, 1964

INVENTOR-NAME: DE SEVERSKY ALEXANDER P

US-CL-CURRENT: 244/62; 244/23R, 310/308, 313/231.31

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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19. Document ID: US 3017630 A

L28: Entry 19 of 22 File: USOC Jan 16, 1962

US-PAT-NO: 3017630
DOCUMENT-IDENTIFIER: US 3017630 A

TITLE: Radar scanning system

DATE-ISSUED: January 16, 1962

INVENTOR-NAME: BEGOVICH NICHOLAS A; ENENSTEIN NORMAN H

US-CL-CURRENT: 342/157, 331/1R, 342/158, 342/184, 342/201, 342/429, 343/771

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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20. Document ID: US 3013266 A

L28: Entry 20 of 22 File: USOC Dec 12, 1961

US-PAT-NO: 3013266
DOCUMENT-IDENTIFIER: US 3013266 A

TITLE: Beam steering apparatus employing ferrites

DATE-ISSUED: December 12, 1961

INVENTOR-NAME: WHEELER MYRON S

US-CL-CURRENT: 342/365; 342/367, 343/754, 343/783, 343/840

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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21. Document ID: US 2605413 A

L28: Entry 21 of 22 File: USOC Jul 29, 1952

US-PAT-NO: 2605413
DOCUMENT-IDENTIFIER: US 2605413 A

TITLE: Antenna system with variable directional characteristic

DATE-ISSUED: July 29, 1952

INVENTOR-NAME: ALVAREZ LUIS W

US-CL-CURRENT: 343/758; 333/248, 333/253, 333/256, 333/258, 342/157, 342/368, 343/760, 343/768, 343/771, 343/797, 343/814, 343/815, 343/816, 343/822, 343/835, 343/894, 343/914

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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22. Document ID: US 2549721 A

L28: Entry 22 of 22 File: USOC Apr 17, 1951

US-PAT-NO: 2549721
DOCUMENT-IDENTIFIER: US 2549721 A

TITLE: Antenna system of variable directivity and high resolution

DATE-ISSUED: April 17, 1951

INVENTOR-NAME: STRAUS HENRY A; GETTING IVAN A ; JEN CHU LAN

US-CL-CURRENT: 343/780, 333/256, 333/35, 343/777, 343/779, 343/781R, 343/783, 343/786

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

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